CHAPTER 14 - WATERSHED AND SOILS

14.1 RESOURCE OVERVIEW

14.1.1 Watersheds

14.1.1.1 Delineated Watersheds

The USGS has divided and subdivided the United States into successively smaller hydrologic units which are classified into 6 levels: regions (largest), sub-regions, accounting units, cataloging units, sub-basins, watersheds and sub-watersheds. Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eleven digits based on the level of classification (UGS 2003).

The planning area is located within the Upper Colorado Region. There are portions of 8 sub-basins and 39 watersheds in the planning area. Sub-basin and watershed boundaries are detailed in Table 14-1 and shown on Figure 14-1.

Table 14-1. Sub-basins and Associated Watersheds, Moab FO Area

Sub-basin	Hydrologic Unit Code (HUC)	Watershed	Acreage
Colorado Headwaters - Plateau	1401000514	West Salt Creek	10,665
	1401000515	Mc Donald Creek-Colorado River	4,817
Westwater Canyon	1403000101	Bitter Creek	100,143
	1403000102	Westwater Creek	168,894
	1403000103	Little Dolores River	6,041
	1403000104	Cottonwood Canyon	131,273
	1403000105	Coates Creek	29,227
	1403000106	Cisco Wash	68,572
	1403000107	Sagers Wash	153,657
	1403000108	Westwater Creek-Colorado River	92,242
Upper Dolores	1403000207	Summit Canyon-Dolores River	17,457
	1403000208	Coyote Wash	79,009
	1403000209	La Sal Creek	50,130
	1403000211	West Paradox Creek-Dolores River	7,468
Lower Dolores	1403000402	Roc Creek	36,596
	1403000405	John Brown Creek-Lower Dolores River	10,156
	1403000406	Beaver Creek-Lower Dolores River	43,609
	1403000407	Granite Creek-Lower Dolores River	91,441
Upper Colorado - Kane Springs	1403000501	Salt Wash	118,814
	1403000502	Courthouse Wash	103,995
	1403000503	Placer Creek-Colorado River	138,894
	1403000504	Mill Creek	91,030

Table 14-1. Sub-basins and Associated Watersheds, Moab FO Area			
Sub-basin	**Hydrologic Unit Code (HUC)**	**Watershed**	**Acreage**
	1403000505	East Canyon-Hatch Wash	13,836
	1403000506	Hatch Wash-Kane Springs Creek	214,274
	1403000507	Harts Draw	9,588
	1403000508	Indian Creek	1,645
	1403000510	Lockhart Canyon-Colorado River	101,189
Lower White	1405000708	Sweet Water Canyon	4,082
	1405000709	Bitter Creek	1,171
Lower Green - Desolation Canyon	1406000507	Rock Creek-Green River	28,919
	1406000509	Florence Creek-Green River	123,027
Willow	1406000601	Main Canyon	12,379
	1406000602	East Willow Creek-Willow Creek	158,742
	1406000603	Hill Creek	59,396
Lower Green	1406000802	Tusher Wash-Green River	137,851
	1406000803	Little Grand Wash	90,226
	1406000804	Salt Wash-Green River	65,499
	1406000805	Tenmile Canyon	175,744
	1406000807	Taylor Canyon-Green River	104,292

14.1.1.2 Critical Watersheds

A critical watershed is a planning designation for a watershed with a high percentage of highly saline soils and/or highly erodible soils. (See Figure 14-2) These watersheds need special management prescriptions to protect resources at risk. Some critical watersheds were delineated in the 1985 RMP.

14.1.1.3 Municipal Watersheds

The Federal Safe Drinking Water Act requires protection of underground sources of drinking water. The State of Utah requires owners of drinking water supplies to establish 2 levels of protection zones around their water sources and to obtain an agreement with the landowner if the applicants do not have complete ownership of the watershed or recharge area. Protection Zone 1 is a circle of a 100-foot radius from the well or margin of collection area. Protection Zone 2 has a two-mile radius or is a variable area based on recharge characteristics. This protection zone can extend up to 15 miles above the source and 300 feet from each stream bank.

The municipalities of Moab, Castle Valley, Thompson, Crescent Junction, Elgin, and Cisco have water supplies that are wells and/or springs with recharge areas on adjacent BLM lands. There are several small public water supply systems within the planning area, including Hole n' the Rock Rest Area, Windwhistle Campground, and Pack Creek Ranch. Thompson, Hole n' the Rock Rest Area, and Pack Creek Ranch filed water source protection plans with the State of Utah that include adjacent BLM lands.

A sole source aquifer designation is a federal acknowledgement that an aquifer system is the sole source of drinking water available to the community. This acknowledgement supports efforts to keep the aquifers free from contamination. The designation requires that federally financially assisted projects in the review area of the sole source aquifer undergo an EPA environmental review for compliance with the goals of the regulation.

Both Moab and Castle Valley have filed for sole source aquifer designation. A total of 24,000 acres in and around Castle Valley has been designated as the sole source aquifer recharge area (EPA 2003). The City of Moab has requested 76,000 acres as its sole source aquifer recharge area (Figure 14-3).

14.1.1.4 Greater Sagers Wash Watershed Management Plan

The Greater Sagers Wash watershed (153,200 acres) was identified as one of the major salt production watersheds in the planning area (BLM 1985). Approximately 60% of the watershed has Mancos Shale derived soils, which are naturally high salt producers. "Erosion, sedimentation, and salt yield in the Greater Sagers Wash Watershed are primarily the result of two processes; natural geologic erosion and accelerated erosion" (BLM 1985:1).

Major land uses that contribute to accelerated erosion include grazing, OHVs, mineral exploration and development, and road building (BLM 1993). Areas undergoing accelerated erosion make up 64% of the watershed and contribute 29% of the potential salt yield (BLM 1993:3). Only the areas with both accelerated erosion and potential for restoration success were analyzed for treatments.

14.1.1.5 Watershed Conditions

In 1998, the State of Utah coordinated an interagency effort called the Unified Watershed Assessment (Utah DEQ 1998). This assessment ranked sub-basins based on documented water quality conditions (Figure 14-4). Category 1 rating was assigned to any sub-basin needing restoration, where at least one sample site did not meet state water quality standards. Category 2 included watersheds meeting goals. Category 3 referred to watersheds with pristine or sensitive aquatic systems. A Category 4 rating was for sub-basins with insufficient data to make an assessment. Only Category 1 and 4 ratings were assigned as part of this assessment. Approximately 1.37 million acres have Category 1 ratings in the planning area, and 1.51 million acres have Category 4 ratings.

14.1.2 Floodplains

Executive Order (EO) 11988, enacted in 1977, requires strict management for floodplains. Floodplains are defined as "the lowland and relatively flat areas … including at a minimum, that are subject to a 1% or greater chance of flooding in any given year," also referred to as a 100-year flood. "Each agency shall provide leadership and shall take action to … restore and preserve the natural and beneficial values served by floodplains."

Stream alteration permits are required by the State of Utah for any activity within a stream channel with riparian vegetation, as per Clean Water Act, Section 404. The Corps of Engineers (COE) retained ultimate enforcement responsibility while granting General Permit 40, giving

enforcement authority to the State of Utah. Figure 14-5 shows oil and gas stipulations intended to minimize watershed damage including floodplain areas within the planning area.

Floodplains are often impacted by roads and associated activities (e.g., maintenance, reconstruction, OHVs). Damage to riparian vegetation and/or channel geomorphology reduces the stream system's ability to withstand flood events. Impacts can be reduced by implementing BMPs, such as buffer strips (protected riparian zones), low angle crossings, crossings nearly perpendicular to stream channels, limited vehicle access, etc.

14.1.3 Soils

14.1.3.1 General

Soils are the medium for plant growth, and provide nourishment for nearly all terrestrial organisms. Soils have developed in residuum, colluvium, alluvium, eolian sands, and loess. They are derived primarily from the sedimentary geologic deposits that occur throughout the planning area. Soil temperature regimes vary from mesic (moderate) at lower elevations to cryic (cold) at higher elevations. Soil moisture ranges from aridic (very dry) to ustic (dry) throughout the Moab FO area, with hydric (wet) soils occurring in riparian and wetland areas.

There are a variety of soil types in the planning area, including highly saline and erodible soils. Sensitive soils need special management to protect resources at risk. This includes management of highly saline and/or highly erodible soils, steep slopes, drought sensitive soils, dust source, and sink areas.

14.1.3.2 Soil Classification

Table 14-2 displays the acreage of soil sub-orders in the Moab FO area and describes each sub-order. Acreage is based on STATSGO data.

Table 14-2. Soil Sub-orders in the Moab FO Area

Soil Order Soil Sub-order	Acreage	Description
Aridisols		
Argids	41,173	Soils found in an aridic soil moisture regime with clay accumulation in one or more subsurface horizons.
Orthids	75,025	Soils found in an aridic soil moisture regime without any exceptional characteristics.
Entisols		
Fluvents	57,471	Floodplain-deposited soils deposited in recent geologic time.
Orthents	1,076,736	Soils deposited in recent geologic time without any exceptional characteristics. Orthents are formed in coluvial and aeolian deposits. These soils are the most wide-spread in the Moab FO area.
Mollisols		
Borolls	82,945	Mollisols formed under cooler temperatures.
Ustolls	673	Dry Mollisols (precipitation occurs more frequently than in Xerolls).
Xerolls	31,051	The driest Mollisols (precipitation occurs less frequently than in Ustolls).

Table 14-2. Soil Sub-orders in the Moab FO Area		
Soil Order Soil Sub-order	**Acreage**	**Description**
Rubblelands, Rock Outcrop, and Badlands	10,787	Lands too steep or harsh for soil development.

Figure 14-6 shows a map of the Soil Suborders in the Moab FO.

14.1.3.3 Sensitive Soils

A *sensitive soils* designation refers to either highly saline or highly erodible soils. Soils derived from Mancos Shale, Morrison Shale, and Summerville/Carmel are considered sensitive soils. These soils have low soil productivity, low nutrient levels, low permeability, compaction susceptibility and low resilience. Once they are disturbed, the impact usually is long lasting (BLM 1993:11). These soils need special management to protect resources at risk.

Additionally, Lusby (1963) studied saline and sodic soils located on the Mancos Shale in Colorado just east of the Utah-Colorado border. His research makes significant conclusions about surface disturbance and associated sediment and salinity loading. Lusby's research area has been resurrected for further study to include the influence and impacts of salts on biotic soil crusts.

14.1.3.4 Erodible Soils

There are soils in the planning area that are susceptible to wind and water erosion. Although these soils have naturally high rates of erosion, the erosion rates are easily accelerated by surface disturbing activities. Best management practices to protect soil stability include limiting surface disturbing activities such as grazing, off road travel, mineral exploration and development, etc.

Wind erosion strips the surface horizon of soil and nutrients necessary for seed germination and plant recruitment. Wind erosion and subsequent deposition can result in the formation and expansion of sand dunes. These soils are especially susceptible to wind erosion when plant cover and/or biological soil crust cover is removed, due to surface disturbance or drought conditions. In the planning area, moderately wind erodible soils occur over 1,303,433 acres (Figure 14-7) based on STATSGO data. Highly wind erodible soils did not occur on BLM-managed lands.

Soils with high potential for water erosion have either a slope over 10% or a *K*-factor (erodibility constant) greater than or equal to 0.32 (BLM 2000a). Water erosion causes the formation of rills and gullies, and can contribute to the sedimentation of streams and reservoirs. Approximately 366,696 acres of water erodible soils occur in the planning area (Figure 14-8).

14.1.3.5 Saline Soils

Soil salinity can affect erosion levels and reclamation potential. Erosion of saline soils impacts the water quality of downstream watersheds. Highly saline soils (with electrical conductivity levels of 8 dS/m or greater) are shown in Figure 14-9, as determined from STATSGO data (BLM

2000a). The planning area contains approximately 314,901 acres of saline soils, primarily confined to the Mancos lowlands along I-70.

14.1.3.6 Drought Intolerant Soils

Certain soil types are severely impacted during drought conditions. The Grand County, Central Part Soil Survey (USDA-SCS 1989) identified a number of drought intolerant soils based on drought conditions and grazing systems (Table 14-3). These conditions are identified, with the specific soils listed afterward.

Severe drought in some years may adversely affect perennial vegetation. Partial or total removal of livestock from the range in these years is a good practice. Severe drought in some years may adversely affect perennial vegetation. Partial or total removal of livestock from the range may be necessary.

Table 14-3. Soils Identified During the Grand County Central Part Soil Survey of 1989 as Being Drought Intolerant

Condition Number	Specific Soil	Condition Number	Specific Soil
7	Blueflat complex	37	Meopitx variant
8	Blueflat-Neiber complex	38	Muff family-badlands complex
11	Chipeta complex	40	Nakai
14	Dune land-Aneth family complex	41	Nakai-Moenkopi complex
18	Hanksville family-Badland complex	42	Nakai-Redlands complex
19	Hanksville family-Shalet complex	43	Nakai-Sheepard complex
21	Hostage-Chipeta complex	44	Pennell
23	Killpack	46	Redbank
25	Killpack-Blueflat complex	47	Redbank-Flatnose families
26	Leeko	55	Rock outcrop-Moenkopi association
28	Mack	56	Sagers
29	Mack-Sagers complex	64	Shalet
30	Mesa	65	Shalet-Nakai complex
31	Mesa-Chipeta-Thedalund	66	Sheppard
32	Mesa-Trook complex	75	Toddler-Ravola-Glenton families association
35	Moekopi-Rock outcrop complex	76	Valleycity-Neiber-Rock outcrop complex

14.1.3.7 Biotic Soil Crusts

Many of the vegetative communities found in the Moab FO area have evolved with the presence of biological soil crusts. Biotic soil crusts are made up of mats or filaments of cyanobacteria, lichens and mosses. Development of biotic soil crust is strongly influenced by soil texture, soil chemistry and soil depth. Crusts are more developed in shallow, sandy, non-saline soils.

Biotic soil crusts play a major role in reducing water and wind erosion and in preventing the establishment of invasive annual grasses (BLM 2001b). They fix atmospheric nitrogen and

carbon, retain soil moisture, and provide surface cover. Crust composition and level of abundance can be used to determine the ecological history and condition of a site (BLM 2001b).

Loss of biotic soil crust leads to reduced soil productivity, decreased plant cover and vigor, and increased wind and water erosion. Severity, size, frequency, and timing of a surface disturbing activity affect the degree of impacts to biotic soil crusts. Fine-textured soils have faster crust recovery rates than coarse-textured soils (BLM 2001a). Aeolian deposition of sediments can bury and kill biological soil crusts by prohibiting photosynthesis.

Managing for healthy biotic soil crusts requires seasonal restrictions for surface disturbing activities. Sandy soils are less susceptible to disturbance when moist or wet, while crusts on fine-textured soils are less susceptible when the soil is dry. (Wet clay soils are susceptible to compaction.) Conditions are best for crust recovery during wet or moist conditions on both sandy and clayey soils.

14.1.3.8 Biological Soil Crust Monitoring

The USGS initiated a study in 2001 to monitor impacts of geophysical activities on different soil types. Soil stability and cover characteristics are measured in the field (including biotic soil crust type). Chlorophyll and nutrient testing is done in the lab. The three soil types studied include MiVida, Mido, and Begay.

Initial results indicate OHV disturbance removes lichen and moss cover, reduces nitrogen inputs, compacts the top 5 cm of soils and reduces soil surface stability (Belnap 2002). Degree of impact differs according to soil type. Mido soils seem to be the most susceptible to compaction and Begay soils are the least susceptible. Mido soils show the highest resistance to surface stability degradation, and MiVida soils are the least susceptible.

The USGS also initiated a sediment transport study to monitor impacts of geophysical activities on different soil types. These involve silt fences set up to trap any sediments moving overland during surface runoff. This information will be important to properly assess impacts from similar projects in the future.

14.1.3.9 Other Limiting Soils

Other soils identified in the Grand Soil Survey had attributes that were limiting to livestock production or range site productivity (Table 14-4).

Table 14-4. Soils Identified During the Grand County Central Part Soil Survey of 1989 as Being Limiting to Livestock Production or Range Site Productivity

Condition Number	Specific Soil	Description of Limitation
10	Chipeta silty clay loam	Limited for grazing due to low production and relative unpalatability of the dominant plants.
11	Chipeta complex	Same as above.
12	Chipeta-Badland complex	Same as above.
13	Dast	Not grazeable by livestock because of steepness of slope.

Table 14-4. Soils Identified During the Grand County Central Part Soil Survey of 1989 as Being Limiting to Livestock Production or Range Site Productivity

Condition Number	Specific Soil	Description of Limitation
22	Hub family	Limited for livestock grazing due to steepness of slope and limited forage production.
24	Killpack-Chipeta complex	Limited for grazing due to low production and relative unpalatability of the dominant plants.
45	Razorba	Used for wildlife habitat.
49	Reva-Falcon families-Rock outcrop complex	Limited for use by livestock because of the steepness of slope, areas of rock outcrop, and low annual precipitation.
53	Rock outcrop	Used for wildlife habitat and recreation areas.
70	Sula-Razorba families complex	Not grazeable by livestock due to steepness of slope.
71	Thedalund-cool	Same as above.
72	Thedalund-moist	Same as above, in addition to surface rock fragments.
73	Thedalund-stony	Not grazeable by livestock due to steepness of slope and low annual precipitation
77	Walknolls family	Suitability for livestock grazing is very poor. The limitations are steepness of slope and low production of forage.

14.1.4 Surface Water

There are three large rivers in the planning area: the Colorado, Green and Dolores Rivers. There are 66 perennial streams (1,062 miles) that flow year-round in at least some reaches. In addition, there are 8,995 miles of intermittent stream systems that flow at least part of the year (more than just storm runoff, UDEQ 2002). Major reservoirs include Ken's Lake. See Figure 14-10 for surface water locations.

Perennial stream segments include all or portions of:

Beaver Creek
Burkholder
Castle Creek
Coates Creek
Colorado River
Cottonwood (Books)
Cottonwood (Black R.)
Cowskin Canyon
Diamond Creek
Dolores River
Fisher Creek
Floy Creek
Granite Creek
Green River
Hatch Wash
Hatch Ranch Wash
Hunter Creek
Kane Creek
La Sal Creek
Little Dolores
Little Water
Mill Creek
Muleshoe Creek
Nash Wash
Negro Bill Creek
Onion Creek
Pack Creek
Poverty Creek
Professor Creek
Rattlesnake Creek
Rill Creek
Ryan Creek
Salt Wash
Seven Mile (north)
Spring Creek
Ten Mile
Thompson Wash
Three Mile Wash
Trough Springs Creek
Tusher (Books)
Westwater Creek

14.1.4.1 Water Quantity

USGS currently monitors stream flow at several sites in the planning area. Table 14-5 shows the current and historic gauge sites and periods of record. Peak flows, yearly averages, and daily statistics are available online.

Table 14-5. USGS Stream Flow Data for Waterbodies in the Moab FO Area

Major Waterbodies	Flow	Median Annual Streamflow/Range	Period of Record
Castle Creek above diversions	Perennial	1.01 cfs/.13 cfs – 3.15 cfs	1950-1975
Castle Creek below Castle Valley	Perennial	6.56 cfs/4.96 cfs – 8.86 cfs	1992-present
Castle Creek below Castleton	Perennial	3.34 cfs/1.65 cfs - 4.44 cfs	1992-2001
Castle Creek near Moab	Perennial	4.34 cfs/4.33 cfs – 4.61 cfs	1950-1958
Colorado River near Cisco	Perennial	7,263 cfs/2,293 cfs- 15,960 cfs	1913-present
Colorado River at Stateline	Perennial	5,779 cfs/2,212 cfs – 13,769 cfs	1952-present
Cottonwood Wash @ I-70	Intermittent	5.98 cfs/5.0 cfs – 6.96 cfs	1983-1986
Dolores River near Cisco	Perennial	662 cfs/143 cfs – 2,021 cfs	1950-present
Floy Wash @ hiway brdge nr I-70	Intermittent	1.03 cfs/0.95 cfs – 1.1 cfs	1983-1986
Green River at Green River, Utah	Perennial	6,018 cfs/1,676 cfs – 12,190 cfs	1894-present
Hatch Wash near La Sal	Perennial	0.92 cfs/0.1 cfs – 4.26 cfs	1950-1971
Mill Creek near Moab	Perennial	13.5 cfs/5.77 cfs – 24.5 cfs	1949-1993
Mill Creek at Sheley diversion	Perennial	9.97 cfs/6.5 cfs – 21.3 cfs	1954-present
Mill Creek below Sheley diversion	Perennial	-	2002- present
Onion Creek ab bridge nr Moab	Perennial	1.24 (1980)	1979-1981
Onion Creek bl bridge nr Moab	Perennial	2.30 (1980)	1979-1981
Onion Creek near Moab	Perennial	1.01 cfs/0.87 cfs – 20 cfs	1950-1955
Pack Creek near Moab	Perennial	4.28 cfs/2.89 cfs – 5.43 cfs	1954-1959
Professor Creek near Moab	Perennial	2.24 cfs/2.0 cfs – 2.47 cfs	1950-1953

1 Based on published USGS data (USGS 2004).

14.1.4.2 Developments and Diversions

Water is diverted from most perennial streams within the planning area. Surface water is diverted to use for irrigation and stock watering. The main use of surface water is the agricultural irrigation of approximately 3,800 acres of land, diverting an average of 18,000 acre-feet annually. The main irrigated crops are alfalfa, small grain, and pasture plants (UDWRe 2000).

Municipal surface water use accounts for diversions of approximately 4,700 acre-feet annually. Industrial use includes mining and mineral processing (e.g., potash solution mining).

14.1.4.3 Water Quality

14.1.4.3.1 General

The State of Utah has assigned every stream segment a series of beneficial uses (Utah DEQ 2000). There are separate water quality standards for each beneficial use classification. The

classifications include drinking water (Class 1C), recreation (Class 2), aquatic wildlife (Class 3), and agriculture (Class 4). Figure 14-11 shows the streams and their classifications.

The BLM monitors surface water quality conditions by conducting both water chemistry and macroinvertebrate studies (see Figure 14-12). BLM participates in a cooperative program with the Utah Department of Environmental Quality (Utah DEQ) to sample sites for water chemistry. BLM personnel take field measurements and samples. The State of Utah provides lab analysis and data management (including maintaining the STORET database, EPA 2003b).

BLM conducts a separate water-chemistry sampling program, independent of the Utah DEQ cooperative program. Field measurements are recorded and samples are sent to EPA certified labs for analysis (i.e., Grand Junction Labs or American West Analytical Labs). A standard sampling protocol is followed.

The Utah DEQ also conducts an intensive sampling program every 5 years. This was conducted from July 2002 through June 2003. Sampling is conducted every 6 weeks on major streams and other requested sites. The next intensive survey will be held in 2007-2008.

With sufficient data it can be determined if a stream is meeting state standards. If a problem is documented, that stream segment will be included by the State of Utah on the 303d list (List of Impaired Waters of Utah) submitted to the EPA every 2 years. A schedule for a Total Maximum Daily Load study (TMDL) is set. This study determines how to reduce pollutants and restore all beneficial uses. The TMDL also establishes the amount of a pollutant allowed in the water.

In 2000, the State of Utah identified Onion Creek, Mill Creek, Castle Creek and Ken's Lake as impaired. The TMDLs were completed in 2002 for Mill Creek, Onion Creek and Ken's Lake. Castle Creek TMDL is scheduled for completion in 2004. (See Figure 14-4 for 303d listed sites.)

The Mill Creek TMDL studied total dissolved solids (TDS) and temperature problems. The TMDL concluded temperature reductions may be attained by 1) maintaining a minimum 3 cubic feet per second (cfs) flow below the Sheley diversion and 2) riparian plantings and stream bank best management practices (BMPs). The TMDL also states the main sources of TDS are natural groundwater inflow and irrigation return flow, both in the Pack Creek watershed. No management prescriptions are made for BLM lands.

The Onion Creek TMDL studied TDS and temperature levels. Current TDS levels cannot be reduced, due to high TDS input from natural sources. The TMDL also states high stream temperatures are a result of poor riparian conditions. Management recommendations include 1) excluding vehicles from the stream channel (including OHVs) and 2) restoring riparian vegetation.

The Ken's Lake TMDL assessed temperature conditions. The report concluded temperature impairment is a result of natural causes. No management prescriptions are made for BLM lands.

14.1.4.3.2 Salinity

Excess salinity is the major surface water quality problem in the planning area, and is of national significance under the Colorado River Basin Salinity Control Act of 1974. Salinity contributions

are from both point sources and nonpoint sources. During low flow periods, salt contribution comes solely from seeps, springs, and groundwater flow. During high flow periods, erosion of saline soils becomes a major contributor to salinity problems.

Point sources for salinity include discharge of saline groundwater from natural springs, seeps, flowing wells, gaining streams, and the release of saline groundwater during drilling activities. The primary nonpoint sources of salinity are the diffuse overland runoff from saline soils and erosion and transport of saline soils during flow events.

The Mancos Shale is recognized as the largest contributor of salinity in the Upper Colorado River Basin (Laronne 1977). There are approximately 314,900 acres of Mancos Shale-derived soils in the planning area. Any surface disturbance on these soils increases erosion and associated salinity contribution.

Fourteen treatment areas in the Mancos Shale have been identified and evaluated for their effectiveness in reducing sediment and salt yields to the Colorado River and for their cost effectiveness (BLM 1993:35). These treatments would increase ground cover, decrease soil compaction, increased infiltration, decrease runoff volume and velocity, and increase on-site sediment retention. The treatments would significantly decrease current salinity contributions.

14.1.4.3.3 Macroinvertebrates

The BLM has an agreement with the Bug Lab at the Utah University in Logan. Macroinvertebrate samples are taken by BLM personnel and analyzed at the Bug Lab. A report is provided to the BLM summarizing data and condition ratings. Data includes species found, diversity index, and biotic condition index.

Macroinvertebrate sampling was conducted in the late 1970s and early 1980s. A recent sampling program was initiated in 1999 and should be completed by 2005.

14.1.5 Groundwater

14.1.5.1 Locations

Groundwater occurs in both consolidated and unconsolidated rock aquifers. The main consolidated rock aquifer is known as the N aquifer, and includes the Wingate and Navajo Sandstones. Water from the N aquifer is generally of good quality and suitable for drinking. Unconsolidated rock aquifers are an important source of groundwater in Spanish Valley and Castle Valley. Recharge is from infiltration of precipitation and stream flow, primarily from the La Sal Mountains.

There are 5 other potential aquifers in the planning area: Entrada, Morrison, Dakota, Wasatch, and Parachute Creek aquifers. These aquifers are not laterally or vertically homogenous (Eisinger 1999). Shallow aquifers are better sources as they usually contain higher quality water and are more easily accessible.

Due to evaporite deposits in the Paradox formation underlying much of the planning area, there is a significant occurrence of briny groundwater, with TDS concentrations exceeding 10,000

milligrams per liter (mg/L). Groundwater quality below the N aquifer is generally saline. The unconsolidated aquifers have the potential for mixing with high saline groundwater, due to no confining layer in between.

Groundwater use in the planning area is not fully documented, due to unreported withdrawal from industry and domestic wells. Groundwater is diverted from both springs and wells. The primary uses of groundwater within the planning area are for potable drinking water supply and industrial supply (UDWRe 2000). In 2002, municipal water suppliers provided approximately 2,850 acre-feet of groundwater for potable supply (includes Moab, Thompson, Grand, and Arches National Park; UDWRi 2003b). In 1996, 940 acre-feet of water was used for industrial purposes (UDWRe 2000).

14.1.5.2 Conditions

Groundwater contamination has been documented surrounding Rio Algom uranium mine, Lisbon Valley mining district (Summo mine area), and Atlas Uranium Tailings pile. Most of the pollution sources are on non-BLM lands, but contamination extends onto adjacent BLM lands.

The Rio Algom mine, located southwest of the town of La Sal, is an inactive underground uranium mine with groundwater contamination. Contamination consists of radio-nucleides (uranium), sulfates, and heavy metals (arsenic, molybdenum, selenium), and extends onto adjacent BLM land. The Rio Algom Mining Corporation has been active in site remediation since 1990, as required by the Nuclear Regulatory Commission (NRC). Groundwater is pumped out of seven wells, and disposed of in two large evaporation ponds. Radon attenuation covers and impermeable layers were installed at the impoundments to eliminate any surface recharge. There are at least 35 active monitoring wells throughout the area. The ponds are on BLM land. The NRC long term site monitoring plan includes a transfer of all private and federal lands affected by the groundwater plume to be transferred to the NRC for monitoring in perpetuity. This transfer process is expected to begin in 2004-2005.

The Lisbon Valley Copper Project, proposed by Summo Corporation, was analyzed in an EIS in 1997. The project is an expansion of an existing mine area, located in the Lisbon Valley mining district. Baseline groundwater data is being collected at 15 wells surrounding the site to assess aquifer characteristics. Data indicates the shallow aquifers are limited in aerial extent because of fault bounding and fracturing. The mine is located on BLM, private, and state lands.

The Atlas Uranium Mill Tailings are the source of significant groundwater contamination adjacent to the Colorado River. Contaminants include radio-nucleides (uranium and vanadium), heavy metals (molybdenum, arsenic), nitrates, and ammonia. The Department of Energy (DOE) is currently preparing an EIS analyzing the final disposal of the tailings pile and subsequent groundwater remediation. Ongoing groundwater studies indicate contamination of both the shallow groundwater zone and deeper brine zones on both sides of the river.

14.1.6 Water Rights

14.1.6.1 Process

Surface water in Utah is allocated through water rights as established by Utah State Law under the doctrine of prior appropriation (1903), or "first in time, first in right." A groundwater connection was established in 1935 through an amendment, allowing the state to appropriate groundwater. A general adjudication of water rights is the judicial process where water rights are determined or decreed by a court of law. Through the adjudication process federal reserve right claims are also asserted, adjudicated and quantified.

As part of the adjudication process a Proposed Determination is published listing all approved applications and assertions. A Final Determination is published with any corrections or adjustments. After the final determination is published, a court decree is completed and the area is closed to further appropriation.

14.1.6.2 Status

The State of Utah has divided the state into separate adjudication areas. There are 3 adjudication areas within the planning area: Area 01, Area 92 and Area 05 (see Figure 14-13). Adjudication Area 05 is divided further into units called "Books."

- Area 01 is fully adjudicated with a recent or pre-trial order adjudication decree, published in 1993. This area is closed to further appropriation.
- Area 92 is currently undergoing adjudication. The proposed determination for Book 92 was published in 1978. Corrections are being made and the final determination is scheduled for publication in 2004.
- All parts of Area 05, except Books 1 and 2, are not actively undergoing adjudication and are still open to application. The adjudication under way for Area 05, Books 1 and 2 (i.e., Professor Valley/Dolores Triangle) is a pilot project for a new method of filing BLM applications in Utah. BLM is to submit one user claim for the entire area. This claim is to reflect usage levels, acre-foot quantities, flow rates, and usage period, and may not be site-specific. The new method is proposed by the State of Utah; the DOI has not officially supported this new filing method.

In addition, 16 other court decrees exist for individual streams within the planning area, including Westwater Creek, Mill Creek, and Pack Creek (UDWRi 2003c).

Federal reserved water rights have not been completely determined with respect to tribal lands in the planning area. These rights are not integrated with state water rights and exist independently of the Utah water rights system.

14.1.6.3 Applications/Rights

Within the planning area, there are 2,282 water right applications filed with the Utah Division of Water Rights (UDWRi) on BLM land (Table 14-6). Of these, 1,873 are filed with BLM as the right owner and 409 are filed with private parties as the right owner, usually grazing permittees.

BLM policy is to convert these applications to BLM ownership through the grazing permit renewal process. See Figure 14-8 for water right locations and status.

Of the 2,282 water right filings, 1,433 are active or perfected. The remaining 849 filings were either terminated, lapsed, or were unapproved. Applications are for surface diversions, underground diversions, and point-to-point diversions (a stream segment rather than a specific point). Most often the use is stock-watering and wildlife. Three perfected rights are for domestic use (Westwater Ranger Station).

Table 14-6. Summary of Water Rights on BLM Land on File with UDWRi

Type of Right	Approved	Perfected	Lapsed, Terminated, or Unapproved	Uses
Point to Point	0	1,090	662	Stock-watering, wildlife
Surface	54	163	121	Stock-watering, wildlife, domestic
Underground	47	62	57	Stock-watering, wildlife
Rediversion	1	9	3	Stock-watering, irrigation, domestic
Return	5	2	6	Stock-watering, irrigation
Total	107	1,326	849	

Source: UDWRi 2003a.

14.1.6.4 Public Water Reserves

Public Water Reserves are the federal reserve rights and accompanying withdrawal of lands containing springs and water holes needed or used by the public for watering purposes. These springs and water holes must be capable of providing enough water for general use by the public for watering purposes. Lands within one-quarter mile of each spring or waterhole are withdrawn from settlement, location, sale or entry and are reserved for public use.

BLM can assert a claim for a federal reserve right based on historic use at any time. The claim is referred to as a diligence claim. Diligence claims for surface water must predate 1903, while claims for groundwater must predate 1935. These federal reserve rights predate state rights.

In 1926, PWR 107 was enacted, stating "every smallest legal subdivision of public land surveys which is vacant, un-appropriated, unreserved public land and contains a spring or water hole, and all land within one quarter of a mile of every spring or water hole … be … withdrawn from settlement, location, sale of entry, and reserved for public use. …"

Previous PWRs were site-specific, listing the springs and water sources. The 1926 PWR 107 did not provide individual site descriptions. BLM interpretation is "all springs and water holes that qualify as a Public Water Reserve Number 107 and that existed as of the date of the Executive Order April 26, 1926, have been reserved even if they have not been recorded on a Master Title Plat or other document" (OR-2002-070). Identification of specific PWR 107 withdrawals is an ongoing process, conducted on an as-needed basis.

14.1.6.5 Instream Flows

Under Utah law, water rights for instream flows for the support of fisheries and recreation may only be held by the Utah Division of Wildlife Resources (UDWR) or the Utah Division of State Parks and Recreation, provided that the rights are purchased from existing water rights holders. There are no instream flow rights located within the Moab planning area. The UDWR has not purchased any conservation pools in lakes within the planning area (UDWR 2002).

The Sheley diversion structure on Mill Creek, which supplies Ken's Lake, is located on BLM lands. The ROW grant for the structure stipulates a minimum stream flow of 3 cfs below the diversion, to satisfy aquatic habitat and riparian needs. This is not considered a water right, but rather a ROW requirement. Due to difficulties meeting this flow requirement, the BLM and USGS are cooperating on the maintenance of a stream-flow gauging station.

14.2 SPECIFIC MANDATES AND AUTHORITY

14.2.1 Federal Laws

- The Economy Act of 1936, as amended, forms the basis for agreements between BLM and the NRCS or USGS concerning soil survey and stream monitoring work.
- The Taylor Grazing Act of 1934, as amended, provides for continued study of erosion and flood control, and provides for any work that may be necessary to protect and rehabilitate public lands to prevent soil deterioration.
- The Appropriations Act of 1952, McCarran Amendment, allows the U.S. to be joined as a defendant in any suit for the general adjudication of water rights.
- The Watershed Protection and Flood Contract Act of 1954, as amended, directs the federal government to cooperate with states and their political subdivisions, soil or water conservation districts, flood prevention or control district, and other local public agencies to prevent erosion or damage from flood waters and sediment.
- The Water Resources Act of 1954, as amended, permits the Secretary of the Interior to give grants to, and cooperate with, federal, state, and local agencies to undertake research into any water problems related to the mission of the Department.
- The Multiple Use Sustained Yield Act of 1960 recognizes recreation, range, timber, watershed, wildlife, and fish resources in a combination that best fits the needs of the American people.
- The Water Resources Planning Act of 1965, as amended, established the Water Resources Council, which is directed to maintain studies of water supplies and water programs. The chairman of any river basin commission can request from an agency, and that agency is authorized to furnish, such information as is necessary to carry out its function.
- The Wild and Scenic Rivers Act of 1968 provides direction, procedures, and standards for management of waters located within the National Wild and Scenic River System.
- The Federal Pollution Control Act, with amendments 1972 and 1977, has the objective of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. The Clean Water Act of 1987 provides additional authorizations.

- The Water Resources Development Act of 1974 directs the Department of the Interior to undertake research and develop demonstration projects to identify methods to improve the water quality of the Colorado River.
- The Colorado River Basin Compact states, which include Utah, have adopted numeric salinity criteria for the basin. Criteria for stations downstream of the planning area include: 723 mg/L salinity below Hoover Dam, 747 mg/L salinity below Parker Dam, and 879 mg/L salinity below Imperial Dam.
- The Colorado River Basin Salinity Control Act of 1974 directs the Department of Interior to undertake research and develop demonstration projects to identify methods to improve water quality obligations with Mexico. The amendment of 1984 directs the Secretary of the Interior to develop a program for minimizing salt contributions to the Colorado River from land administered by the BLM.
- The Federal Land Policy Management Act of 1976 requires that public lands be managed in a manner that will protect scientific, environmental, air and atmospheric, and water resource values. It also requires land use plans to be in compliance with applicable pollution control laws, including state and federal air, water, and other pollution standards.
- The Surface Mining Control and Reclamation Act of 1977 requires federal agencies to gather hydrologic data to ascertain the suitability for mining.
- The Safe Drinking Water Act of 1977 protects all public water systems from pollutants or contaminants that would endanger public health and welfare. Activities on public lands in these watersheds must not cause contaminant levels to exceed promulgated standards.

14.2.2 Executive Orders (EO)

- EO 11288 (July 2, 1966) requires heads of agencies to provide leadership in the field of water quality management and requires that federal facilities develop pollution prevention plans.
- EO 11507 (February 4, 1970) directs the federal government in the design, operation, and maintenance of its facilities to provide leadership in the nationwide effort to protect and enhance the quality of air and water resources. It provided for action necessary to correct air and water pollution at existing facilities and required surveillance to ensure that water quality standards are met.
- EO 11738 (September 10, 1973) directs each federal agency to enforce the Clean Water Act in the procurement of goods, materials, and services.
- EO 11752 (December 17, 1973) mandates that federal agencies shall provide leadership to protect and enhance the quality of air, water, and land resources through compliance with applicable federal, state, interstate, and local pollution standards.
- EO 11988 (May 24, 1977) directs each federal agency to take action to avoid the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Agencies are required to avoid direct or indirect support of floodplain development whenever there is a practicable alternative.

- EO 11990 (May 24, 1977) directs federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial value of wetlands in carrying out programs affecting land use.
- EO 12088 (October 24, 1978) requires all federal agencies to comply with local standards and limitations relating to water quality. Each federal agency is bound to recognize and adopt the policies, goals, and standards of area-wide water quality management plans in regard to those federal lands under its jurisdiction and to implement the standards of the plans to the maximum extent feasible in its own planning process and management activities.
- EO 12322 (September 17, 1981) requires that any report, proposal, or plan relating to a federal or federally assisted water and related land resources project or program must be submitted to the Director OMB before submission to Congress.

14.2.3 Regulations

- The U.S. Water Resource Council published Floodplain Guidelines on February 10, 1978, after being directed to establish guidelines for floodplain management and preservation.
- Arizona has promulgated water quality standards through the EPA on the Colorado River at the Utah state line to limit the amount of total phosphates and nitrates (40 CFR 131.31).
- Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management (Federal Register, October 18, 2000).

14.2.4 Circulars

- OMB Circular A-67 (August 28, 1964) provides guidelines for coordination of water data activities and states that the USGS shall acquire basic data on the nation's water resources. It further states that other agencies shall acquire special water data in support of their respective missions and that these activities must be closely coordinated to assure effective and economical management of resources.
- OMB Circular A-81 directs that federal agencies need to meet water quality standards and related plans that states have developed under the Federal Water Pollution Control Act and cooperate with state and local pollution control agencies and with other federal agencies in the evaluation of their pollution control needs.

14.2.5 Bureau Manuals

- H-6740. Establishes policy and procedures for the identification, protection, maintenance, and management of fresh, brackish, and saline waters wetland areas.
- H-7120. Provides guidelines for maintaining all BLM watershed improvements constructed on public lands.
- H-7150. Provides guidance in the conduct and maintenance of water utilization and development, water quality, water yield and timing, and water rights.
- H-7160. Provides general guidance for preventing water and wind erosion.

- H-7210. Provides the basic framework for the soil and watershed activity.
- H-7221. Describes the policies, responsibilities, and procedures used to incorporate floodplain management into all BLM activities.
- H-7240. Describes the policies to protect, restore, and enhance the quality of water on public lands so that its utility for other dependent ecosystems will be maintained equal to or above legal water quality criteria.
- H-7250. Establishes policy and guidance for acquiring, perfecting, and protecting water rights necessary for multiple-use management.
- H-7316. Provides procedures for inventory and analysis of ground and surface water inventories and of erosion and sediment reduction.
- H-7322. Provides procedures for analyzing watershed problems and developing plans for improving watershed conditions.
- H-8351. Wild and Scenic Rivers - Policy and Program Direction for Identification, Evaluation, and Management.
- Utah's Standards and Guidelines for Rangeland Health.
- Utah Strategic Riparian Plan.

14.2.6 Bureau Instruction Memoranda and Information Bulletins

- IM-78-410. Sets BLM policy on protection of wetlands and riparian areas.
- IM-78-523. Compliance with BLM interim floodplain and management procedures.
- IM-87-261. Implementation of the Riparian Area Management Policy.
- IM 99-085. Federal Multi-Agency Source Water Agreement.
- IM-99-123. Reporting to the Colorado River Salinity Control Forum.
- IM-2000-179. Funding of Water-Related Restoration and Cleanup Projects on Private and other Non-BLM Lands.
- UT 2000-081. Handling Applications of Municipalities Water Source Protection Plans.
- UT 98-28. Riparian Performance Measures.
- UT-97-73. Implementing Standards for Rangeland Health and Guidelines for Grazing Management on BLM Lands in Utah.
- IB 98-116. Clean Water Action.

14.2.7 Bureau Technical Notes

- 405. A framework for analyzing the hydrologic conditions of watersheds.
- 373. Diffuse-source salinity: Mancos Shale terrain.
- 372. Stream discharge measurement using a modified technique.
- 371. Determining hydrologic properties of soil.
- 369. Considerations in rangeland watershed monitoring.
- 365. Hydrology and USLE: application to rangelands.

- 364. 1980-82 salinity status report: results of Bureau of Land Management studies on public lands in the Upper Colorado River Basin.
- 346. Erosion condition classification system.

14.2.8 Applicable Utah State Laws and Regulations

- Utah Code, Title 73, Water and Irrigation. Provides framework for appropriation of waters of the state.
- R309-600. Provides for source protection of groundwater drinking water sources.
- R309-605. Provides for source protection of surface water drinking water sources.
- R317-2. Provides standards of quality for waters of the state.
- R317-6. Provides rules for groundwater quality protection.
- R317-8. Provides for the Utah Pollution Discharge Elimination System (UPDES).
- Utah Nonpoint Source Management Plan (October 2000), including amendment for Nonpoint Source Management Plan for Hydrologic Modifications (March 1995) and Nonpoint Source Management Plan for Silviculture Activities (July 1998).

14.2.9 Specific Water Quality Standards

R317-2 of the Utah Administrative Code provides the standards for water quality in the State of Utah. Waters are classified by use (domestic, recreation, wildlife, agriculture), with special reservations made for waters specifically determined by regulation to be High Quality Waters (there are no High Quality Waters designated within the planning area). Use classifications of major water bodies within the planning area and their associate surface water quality standards are summarized in Appendix 14-A.

14.3 CURRENT MANAGEMENT PRACTICES

The Grand RMP identified specific management actions to help control sedimentation and salinity in the Upper Colorado River basin and to prevent disturbance and degradation of critical watersheds and floodplains. These management actions were not implemented, and include the following:

- Installation of instream drop-structures in eight streams to decrease sedimentation and improve water quality. All proposed projects were located in the Book Cliffs.
- Implementation of salinity control treatments such as gully plugs, contour furrows, and retention dams on 41,000 acres to reduce salinity contribution.
- Diversion and evaporation of water from Stinking Spring to reduce salinity contribution.
- Manipulation of vegetation and watershed treatments on 313,800 acres to improve poor watershed condition.

The Grand RMP also called for continued inventory of water resources, continued monitoring of water quality in perennial streams, and collection of climatological data. Stream system surveys, water quality and precipitation data collection is ongoing.

The Greater Sagers Wash Management Plan was completed in 1993 (BLM 1993), with the objective of reducing annual sediment and salt yields from the watershed to the Colorado River by 5,600 tons/year and 200 tons/year, respectively. The plan includes the following:

- A description of watershed characteristics including vegetation, soils, and precipitation.
- Identification of salt-producing areas undergoing accelerated erosion with the greatest potential for salt management.
- Identification of potential treatments for controlling sediment and salt production.
- Economic feasibility evaluation for each treatment.
- Analysis of different alternatives based on combinations of treatments.
- Strategies for project monitoring, maintenance and evaluating project success.

Suggested treatments would reduce salt loading. Other benefits of the treatments are:

- An increase in overall vegetative cover, plant density and diversity.
- Better distribution of livestock resulting in better utilization of forage.
- Additional allocations of available forage to wildlife, especially in critical winter range.
- Improved habitat for wildlife as a result of increased numbers of water sources available.
- Improved riparian condition.
- Improved soil condition and productivity.

The preferred alternative is a combination of 1) reallocating 3,000-4,000 AUMs on Cisco Allotment, 2) sagebrush chopping on select areas, and 3) continued monitoring of existing retention and detention structures in upper watershed. Due to current sagebrush concerns, this portion of the recommended treatment should be re-evaluated.

The RMP has not been amended in regards to this plan, and no treatments have been implemented to-date.

EPA Storm Water Rules Phase III came into effect in March 2003. These rules require a permit be obtained from the State of Utah for any construction activity that disturbs one or more acres of land. The permit may be waived if construction is conducted entirely between January 1 and April 30. The permit must be maintained until site stabilization is complete (cover vegetation must be 70% of pre-existing conditions).

A stormwater pollution prevention plan is submitted with the permit application. In the plan, sources of stormwater pollution are identified and appropriate BMPs are selected to control stormwater sediment and erosion. BMPs may include silt fences, vegetation filter strips, reseeding and mulching, etc. BLM actions that would apply include construction of campgrounds, stockponds, and roads.

The Utah Rangeland Health Standards include four separate standards to be met by BLM:

1. upland soils that exhibit permeability and infiltration rates that sustain or improve site productivity;

2. riparian and wetland areas that are in properly functioning condition, with stream channel morphology and functions appropriate to the soil type, climate, and landform;
3. desired species are maintained at appropriate levels;
4. and BLM compliance with State of Utah water quality standards, Clean Water Act, and Safe Drinking Water Act, with activities on BLM land supporting the beneficial uses described by the State of Utah Water Quality Standards for surface and groundwater.

BLM is a cooperating agency with respect to implementation of salinity control measures on the Colorado River. Although salinity contributions have two components, point source and nonpoint source, nonpoint source contributions are most important in the planning area. Nonpoint source controls include planning decisions, vegetation management, construction and maintenance of watershed structures, and use authorizations.

14.4 RESOURCE DEMAND AND ANALYSIS

The current demand for maintaining or reducing salinity and sedimentation in the Colorado River system will continue to become more important. The demand for recreation opportunities is also increasing (approximately 2 million visitors per year). Recreation includes dispersed off-road driving (e.g., ATVs and dirt bikes), large organized events (i.e., Book Cliff Rattlers, Jeep Safari, etc.), dispersed and developed camping, and both commercial and non-commercial horse use. Mineral exploration and development is ongoing. The demand for grazing activity is expected to continue. Impacts from these surface disturbing activities will continue to increase, raising salinity and sedimentation contributions.

The planning area is currently in the fifth year of drought conditions. Since the year 2000, drought conditions have been extreme to exceptional (Utah Climate Center 2004). The USGS is predicting drought conditions to persist for several decades (Gray et al. 2003). Any surface disturbing activity will have greater and longer lasting impacts on watersheds during drought conditions. Impacts include reduced soil health, reduced vegetative health, impaired water quality as well as increased wind and water erosion.

The Utah Division of Water Resources (UDWRe) expects demand for drinking water in the Southeast Colorado River Basin (Grand and San Juan Counties) to increase to approximately 5,300 acre-feet in 2020 and to approximately 15,800 acre-feet in 2050. Based on available supplies, shortfalls are predicted to occur in Moab by 2050 (UDWRe 2000). As water needs increase for domestic and irrigation use in the Moab Valley, maintaining a minimum streamflow in Mill Creek will become more politically charged and difficult to enforce.

The planning area is considered by the State Engineer to be fully appropriated (in regards to water rights) or to have scarce water sources. Future appropriations of water will require alteration or retirement of existing rights in adjudicated areas.

14.5 CONSISTENCY WITH NON-BUREAU PLANS

Watershed activities and plans that involve non-BLM administered property are coordinated with the appropriate private landowners, permittees, and state, federal, or local agencies. BLM

frequently coordinates with the State of Utah, U.S. Forest Service, U. S. Geological Survey, Grand and San Juan Counties.

The Utah State Water Plan (UDWRe 2000) identifies several issues of concern for the planning area. Issues include:

- The continued installation of residential septic tanks and drain fields that may pose a threat to local groundwater aquifers;
- The operation of tailing ponds at some local mining operations that may contaminate regional aquifers;
- The need for long-range groundwater plans that identify potential contamination problems and establish necessary management criteria.

Although few septic tanks are located on BLM lands, there are 89 vault toilets at recreation sites and campgrounds. The vaults are pumped and waste is deposited in the City of Moab sewage treatment plant.

The Keystone-Wallace mine tailings ponds are located on BLM land at the north end of the Lisbon Valley. Current management of these ponds is minimal, and avoidance related.

Several planning documents exist for Grand County, including the 1996 Grand County General Plan and the General Plan Update (2004), and a Water Management and Conservation Plan for the Grand Water and Sewer Service Agency. Among the policy issues addressed in the Grand County General Plan (Grand County 2004) is the desire to "promote management of public lands for the benefit and enjoyment of the people of Grand County and the nation." Specific policy issues concerning BLM watersheds include the following:

Public Lands Policy 2. Grand County will work to protect watersheds from activities and uses that are injurious to them. Public agencies are encouraged to adopt policies that enhance or restore watersheds for Moab, Spanish Valley and Castle Valley. Grand County will support classification of the aquifers for these valleys at the highest possible quality standard. The County encourages the agencies managing the public land in the EPA's sole source aquifer recharge areas for Moab, Spanish Valley and Castle Valley to define "proper functioning condition" to include capturing rainfall into the groundwater aquifer at nondegraded rates.

A total of 24,000 acres in and around Castle Valley have been designated as the sole source aquifer recharge area (EPA 2003a). The City of Moab has requested 76,000 acres as its sole source aquifer recharge area. This policy encourages BLM to enhance watershed quality in this zone, as well as to increase aquifer recharge. This is consistent with BLM's management direction. Efforts to reduce erosion, sedimentation, and salinity generally coincide with less runoff and more infiltration of rainfall. However, BLM's current management direction does not specifically consider aquifer recharge as management criteria.

The Manti-LaSal National Forest occupies approximately 140,000 acres within the planning area. Management of the National Forest is based on the 1986 Forest Land and Resource Management Plan (USFS 1986). Specific goals of the Plan with respect to soil and water are as follows. These goals are largely compatible with the management direction of the BLM:

- Maintain satisfactory watershed conditions;
- Provide favorable conditions of water flow (quality, quantity, timing);
- Protect National Forest System lands or resources from unacceptable damage caused by the development of water uses;
- Improve deteriorated watershed conditions where feasible;
- Provide sufficient water for multiple-use management by securing favorable flows of water, which is interpreted to include those flows necessary to maintain stable and efficient stream channels as required by the Organic Act of 1897, and provide for fish and wildlife habitat, recreation, and livestock use as required by the Multiple Use Act of 1960;
- Protect soil and water productivity so that neither will be significantly or permanently impaired; and
- Protect and enhance riparian areas including dependent resources.

The State of Utah completed TMDLs for Mill Creek, Onion Creek and Kens Lake. These water quality assessment reports include management recommendations to improve impaired conditions. Improvements in riparian condition and maintenance of stream flow are needed to reduce stream temperatures in Mill Creek. For Onion Creek, recommendations include limiting vehicle traffic within stream channel, improving riparian conditions, and addressing road impacts. The impairment at Kens Lake was determined to be natural and unavoidable

14.6 ISSUES AND CONCERNS

The primary watershed concern identified in the RMP was the prevention and reduction of salinity and sedimentation from public lands. This was to be accomplished through improved management of targeted critical watershed areas. This is still a major issue. Any surface disturbing activity on sensitive soils will cause increases in salinity and sedimentation levels. Surface disturbing activities currently occurring on these soils include: recreation, grazing, roads and mineral-related actions. Both commercial and non-commercial horse use impact sensitive soils in Mill Creek and Castle Creek.

An issue of recent concern is the ongoing drought throughout the planning area. Since 1998, the planning area has suffered severe to extreme to exceptional drought conditions (Utah Climate Center 2004). Drought has affected vegetation and soil moisture, with watershed health declining accordingly. Major decreases in the amount of groundcover, the vigor and diversity of plants, and soil moisture levels have been documented.

With the drought, there is an increase in wind erosion and associated impacts. In 2003, severe dust storms occurred on I-70 causing several multi-vehicle accidents. Most accidents were in the Greater Sagers Wash Watershed. The upper Ten Mile Wash area has been identified as a natural wind tunnel, initiating significant aerial sand transport and deposition downwind.

Many activities cause impacts to watersheds by impacting soil health and water quality. Surface disturbing activities include grazing, off road travel, large recreation events, mineral exploration/development, and roads. Impacts include soil compaction, decreased soil stability,

loss of vegetation and biotic soil crusts, loss of functioning floodplains, accelerated erosion, water quality degradation, and increased salinity contributions.

Timing of surface disturbing activities is a concern. Spring time is when ecosystems naturally heal, with good moisture and growing conditions. This is also the season of highest recreation use. Grazing also occurs throughout the spring.

Road construction and maintenance in floodplains of perennial and intermittent stream systems is an important issue. Impacts to the associated riparian zone are related. Streams with major road conflicts include Onion Creek, Kane Creek, Ten Mile Wash, Bartlett Wash, Tusher Wash, Cottonwood Creek, Diamond Creek, and Westwater Creek.

Maintaining stream flow in Mill Creek below the Sheley diversion is an issue. Grand County Water Conservancy District maintains the diversion, which supplies Ken's Lake and irrigation users. The required 3 cfs to remain in the stream is sometimes not provided. This affects both riparian and aquatic systems, and subsequently water quality conditions.

Additional concerns include protection of municipal water supplies, protection of groundwater, and management of water supplies for wildlife and livestock.

14.7 MANAGEMENT OPPORTUNITIES AND LIMITATIONS

14.7.1 Management Opportunities for Watersheds

- The Greater Sagers Wash Watershed Management Plan can be adopted. The plan called for reallocating AUMs, conducting vegetation treatments, and continued monitoring of existing retention and detention structures. These measures would reduce annual sediment and salt yields from the watershed to the Colorado River by 5600 tons/year and 200 tons/year, respectively. Other benefits from the proposed measures include:
  - An increase in overall vegetative cover, plant density and diversity
  - Better distribution of livestock resulting in better utilization of forage
  - Additional allocations of available forage to wildlife, especially in critical winter range areas
  - Improved habitat for wildlife as a result of increased number of water sources available
  - Improved riparian area conditions
  - Improved soil condition and productivity
- Identify areas of current or potential accelerated erosion. Develop BMPs for these areas to reduce erosion.
- Re-evaluate and enlarge critical watershed areas based on highly saline or erodible soil.
- Build and maintain existing exclosures on sensitive soils to document natural changes and assess impacts.
- Develop BMPs to reduce salinity contributions and accelerated erosion. Develop BMPs for each surface disturbing activity (i.e., grazing, mineral exploration, OHV, recreation events, roads, etc.).

- Define desired future conditions and stream habitat goals for each perennial and intermittent stream system.
- Determine where watershed management plans are needed, due to high levels of activity.
- Identify priority watersheds based on resource conditions, stabilization needs. Define management criteria for actions allowed.
- Develop drought management strategies.
- Continue to monitor stream flow in Mill Creek downstream of Sheley diversion. Require diversion structure to be rebuilt in order to let minimum flow remain in stream.
- Reevaluate planning designations i.e., oil and gas leasing stipulations, OHV travel designations in order to better manage for salinity and sedimentation control.
- Continue to work with Grand County on Onion Creek road issues and other areas with road/stream interactions.
- Amend grazing management to include seasonal rotation, spring rest and exclusion from critical areas (such as saline soils, fragile soils with high erodability, and riparian areas) .
- Follow new federal stormwater regulations, every project with more than 1 acre of surface disturbance needs a stormwater permit from the Utah DEQ.
- Identify watershed ACECs.
- Recognize sole source aquifer designations and water source protection zones (municipal watersheds), identify drinking water sources without protection zones.

14.7.2 Management Opportunities for Floodplains

- Define desired future conditions for floodplains.
- Collaborate with Grand County on road construction and maintenance in floodplains i.e., Onion Creek, Cottonwood Creek, Bartlett Wash, Diamond Creek, Kane Creek, etc. Develop BMPs.
- Expand floodplain areas for Oil and Gas leasing categories.
- Develop grazing systems in riparian and wetland areas.
- Create a management/travel plan for Ten Mile Canyon.

14.7.3 Management Opportunities for Soils

- Build and maintain existing exclosures to document natural changes and assess other impacts.
- Identify soil ACECs and areas that need increased soil productivity, stabilization, restoration, and/or long term rest.
- Reevaluate critical watersheds, and enlarge them based on highly salinity and/or erodibility.
- Develop BMPs by activity for each critical watershed. Complete watershed management plans as necessary.
- Develop drought management strategies.

- Surveys of biotic soil crusts should be conducted to correlate types of biological crusts with NRCS soil map units (USDA NRCS 2003).
- Implement the recommended BMPs listed in the BLM Technical Reference 1760-2, Biological Crusts: Ecology and Management, 2001.
- Soil erosion condition and sediment yield trends should be evaluated by establishing permanent monitoring sites at representative locations.
- Vegetation diversity and density should be improved on soils with high erosion potential.

14.7.4 Management Opportunities for Surface Water

- Develop BMPs to reduce nonpoint source salinity and sedimentation. BMPs may include protection of sensitive soils, stabilization of actively down-cutting channels, improvement of watershed health with documented water quality issues, protection of floodplains and riparian areas.
- Identify areas of current or potential accelerated erosion.
- Identify instream flow needs and pursue them.
- Watershed management plan to restoring water quality of streams not meeting state water quality standards (implement TMDL recommendations).
- Develop drought management strategies.

14.7.5 Management Opportunities for Groundwater

- The Keystone-Wallace mine tailings ponds are a potential threat to groundwater and need a monitoring plan and/or reclamation to protect groundwater quality.
- Allow continued monitoring of groundwater surrounding Rio Algom by DOE. Prevent any groundwater developments adjacent to this area.
- Continue with abandoned mine reclamation at La Sal Creek. Reclamation must address water quality problems.
- Recognize sole source aquifer designations and water source protection zones (municipal watersheds), and identify drinking water sources without protection zones.

14.7.6 Management Opportunities for Water Rights

- Identify measures to ensure water availability for multiple-use management and functioning healthy riparian and upland systems.
- Assert Matrimony springs PWR right to ensure recreation opportunities.
- Identify areas that need additional water developments for wildlife and livestock. These would primarily be guzzlers or wells (via windmill or solar power). Additional water supplies could replace or augment existing water supplies located in critical areas, such as riparian zones and areas with unstable soils or highly saline soils.
- File for water rights in un-adjudicated areas as-needed and if possible.
- Compile comprehensive list of Public Water Reserves.

14.8 REFERENCES

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APPENDIX 14-A

Table WS-1. Use classifications for water bodies in the planning area, with respect to State of Utah surface water quality standards.

River Segment	Use Classifications								
All waters not specifically classified			2B				3D		
Colorado River and tributaries, from Lake Powell to state line except as listed separately	1C		2B		3B				4
Little Dolores River and tributaries, from confluence with Colorado River to state line			2B			3C			4
Mill Creek and tributaries, from confluence with Colorado River to headwaters	1C		2B	3A					4
Kane Canyon Creek and tributaries, from confluence with Colorado River to headwaters			2B			3C			4
Roc Creek and tributaries, from confluence with Dolores River to headwaters			2B	3A					4
Dolores River and tributaries, from confluence with Colorado River to state line			2B			3C			4
LaSal Creek and tributaries, from state line to headwaters			2B	3A					4
Lion Canyon Creek and tributaries, from state line to headwaters			2B	3A					4
Bitter Creek and tributaries, from confluence with Colorado River to headwaters			2B			3C			4
Thompson Creek and tributaries from Interstate Highway 70 to headwaters			2B			3C			4
All irrigation canals and ditches statewide,									4
All drainage canals and ditches statewide,								3E	
All lakes not listed below are assigned by default to the classification of the stream with which they are associated.									
Dark Canyon Lake	1C		2B	3A					4
Ken's Lake			2B	3A					4

1C – Protected for domestic purposes with prior treatment
2A – Protected for primary contact recreation such as swimming
2B – Protected for secondary contact recreation such as boating or wading
3A – Protected for cold water species of game fish and aquatic life
3B – Protected for warm water species of game fish and aquatic life
3C – Protected for nongame fish and aquatic life
3D - Protected for waterfowl, shore birds and other water-oriented wildlife
3E – Severely habitat-limited waters
4 – Protected for agricultural uses including irrigation and stock watering

Table WS-2. State of Utah surface water quality standards for designated uses for selected constituents of concern.

Contituent	Use Classifications								
	1C	**2A**	**2B**	**3A**	**3B**	**3C**	**3D**	**3E**	**4**
pH	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0		6.5-9.0
Total dissolved solids (mg/L)									1200
Total suspended solids (mg/L)		90	90	35	90	90			
Total Phosphorus[1] (mg/L as P)		0.05	0.05	0.05	0.05				
Minimum Dissolved Oxygen[2] (mg/L)				6.5	5.5	5.0	5.0		
Maximum Temperature (C)				20	27	27			
Nitrates (mg/L)	10	4	4	4	4	4			

[1]Total Phosphorus limit for lakes and reservoirs shall be 0.025
[2]30-Day Average

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